Performance Analysis of Different Routing Protocol in VTDN: A Survey

Kiranbhai N Parmar[1],Trupesh Patel[2]
[1]*Department of Information Technology,Silver Oak College of Engineering and Technology, Ahmedabad, Gujarat, India*
[2]*Assistant Professor,Silver Oak College of Engineering and Technology, Ahmedabad, Gujarat, India*

***Abstract*—Vehicular Delay Tolerant network (VDTN) are rising stimulating field of Delay Tolerant Network (DTN). In VDTN, mobile nodes (vehicles) are communicate using the pattern of store carry and forward. In low density, high mobility of nodes, intermittent network, no end-to-end communication network, the traffic is sparse. Routing in such cases are very difficult and challenging due to the less contact opportunity between the nodes. In this paper VDTN different routing protocol are analyzed and compared in terms of Delivery Probability, Overhead Ratio and Average Latency. For performance Analysis of the routing protocols, various simulations are carried out in The ONE Simulator with Version of 1.5.1.**

***Index Terms*—DTN, VDTN, Routing protocols, ONE**

I. INTRODUCTION

Delay Tolerant Network (DTN) [1] is a network designed to provide communications in the most unstable and stressed environments, where the network would be visit and durable interruptions and high piece mistake rates that could frequently debase the execution. Since a large portion of the nodes in a DTN are versatile, the availability of the network is kept up by nodes just when they come into the transmission scopes of each other.

In the communication that any node has information to send yet it is not associated with another node, it stores the message until a suitable correspondence opportunity emerges. In a genuine situation the vehicles are appropriated over a wide region and move randomly, and the network is easily partitioned. These qualities of vehicular systems are like DTNs. Subsequently, vehicular systems can be dealt with as DTNs and characterized as Vehicular Delay Tolerant Network (VDTNs). Vehicular Delay-Tolerant Networks (VDTNs) [2] are DTNs where vehicles contact with each other and with altered nodes put in along the road in request to disperse messages. Some potential VDTN applications are: progressing road security (e.g., agreeable crash shirking, crisis break cautioning, street peril warning), notice of movement conditions (unforeseen jams), observing systems for sensor information accumulation (e.g., climate conditions, contamination estimations and street surface conditions), excitement applications (e.g., Internet get to and interactive media sharing). VDTN situation is shown in fig.1.

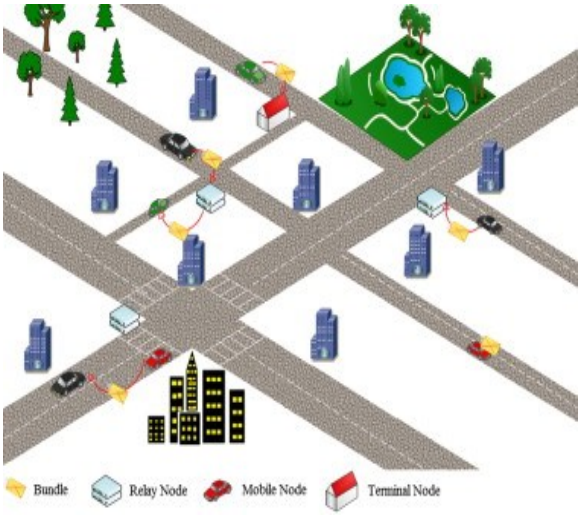

Fig.1: VDTN Scenario [3]

Generally, the package convention of DTN does not give subtle elements of courses to information bundles between the nodes. It deals just with the sending stage. Since, empowering end-to-end availability in vehicular systems is a critical issue and should be tended to by proper routing approaches, therefore, various studies have been done for relevant routing protocol in view of various plans, for example, model based plans, epidemic plans, and estimation plans.

There are different routing protocol are proposed and arranged for DTN and there are a few parameters

important to judge the execution of them. Some of them are number of messages dropped and aborted, total number of messages delivered, Delivery probability, Latency average, number of duplicates of message in the network, Overhead ratio.

In this paper we have mostly focused just on four routing protocols which are Direct delivery, Epidemic Router, PROPHET routing protocol and Spray and Wait routing protocol and to break down the execution of them we have focused for the most part on three parameters which are Delivery Probability, Overhead proportion and Latency Average.

II. ROUTING PROTOCOLS OF VDTN

a) Direct Delivery Routing:

Direct delivery [4] is the simple routing module and it is single copy scheme of DTN routing protocol. The Direct Delivery module does not start any further communications after exchanging the deliverable messages since it will send messages only if it is in contact with the final recipient. This saves buffer size and bandwidth but is not clearly an ideal approach in many cases if a high message delivery probability is the goal.

In this method, the source node does not forward the message to the middle nodes. The source node keep message with it till it becomes directly interact to the destination node. Hence, if there is no contact occurs between source and destination, the message will be lost as there is only single copy is available in to the network.

b) Epidemic Routing:

Epidemic routing is based on Flooding paradigm. Each node maintains two buffers. First buffer is used for kept the messages. This is created by the node itself. Second buffer is utilized for the message received from the other node. Every message has one unique message ID related with it. Every nodes contains a records of the message IDs of all messages in its buffer and pending conveyance is spared in type of rundown vector. At the point when two nodes are experience, they looking at their outline vectors. Two nodes exchange all messages which they don't have in mutual. After the message exchanging process, several copies of the message routes in the network. Each node have same messages in their buffer and all messages are spread to the each node into the network including the terminus node.

c) PROPHET Routing:

The Probabilistic Routing Protocol using History of Encounters and Transitivity (PRoPHET) [5] is routing protocol in which every node computes a probabilistic metric called Delivery Predictability for every known terminus before transfer a message. Delivery Predictability specifies the probability of successful delivery of the message from the source node to the terminus node. A node will forward the message to another node, if another node has a higher cost of Delivery Predictability.

d) Spray and wait Routing:

Spray and Wait [6] is a multiple copy routing protocol. The Spray and Wait routing protocol is categorized into two phase, spray phase and wait phase.

In the Spray Phase, all messages are activated at the source node and passed to L decided relays in the network. Source node spreads L copies of the message to the first L encountered nodes in the network.

In the wait phase, every node that received a copy of the message is waiting for delivery confirmation. There are two version: Spray and Wait and other is Spray and Wait Binary mode.

In typical mode, a node gives one replica of the message to every node experienced that does not have same replica. In Spray and Wait Binary mode (SnWBinary), half of the n replica to the principal node experienced and that node transmits half of the replica to the one it experiences first this procedure is proceed until one replica is left with the node.

III. SIMULATION SCENARIO

Simulation scenario are made by characterizing simulated nodes and their qualities. In Scenario-1, to evaluate the performance of the Direct Delivery, Epidemic, Prophet routing and Spray and Wait routing, we have run the simulation for 25000 seconds for each routing protocols individually. In the simulation 300 minutes for message TTL time is fixed. The other information for the simulation is shown in Table-1.

Parameters	*Values*
Simulation Time	25000 sec
No. of Nodes	40,50,60,80,100
Transmit Speed	2 Mbps
Transmit Range	10
Interface	Bluetooth Interface
Interface Type	Simple Broadcast
Buffer size	5 MB
Routing Protocols	Direct Delivery, Epidemic, SprayAndWait, Prophet
Message sizes	500KB-1MB
Message TTL	300 min

Table-1: Scenario-1 parameters for Simulation

In Scenario-2 instead of fixed message TTL we vary it ranges from 50 to 300 minutes and number of nodes are retained fixed by 40. The other information for the simulation is shown in Table-2.

Parameters	*Values*
Simulation Time	25000 sec
No. of Nodes	40
Transmit Speed	2 Mbps
Transmit Range	10
Interface	Bluetooth Interface
Interface Type	Simple Broadcast
Buffer size	5 MB
Routing Protocols	Direct Delivery, Epidemic, SprayAndWait, Prophet
Message sizes	500KB-1MB
Message TTL	50,100,150,200,300 min

Table-2: Scenario-2 parameters for Simulation

To evaluate the performance of all the routing protocols we mainly focused on three parameters. These parameters are defined as follows:

1. Delivery Probability: It is defined as the proportion of the quantity of messages correctly delivered to the terminus and the quantity of messages sent by the source.
2. Overhead Proportion (Ratio): It is defined as the proportion of difference between the aggregate number of transmitted messages and the aggregate numbers of delivered messages to the aggregate number of delivered messages.
3. Average Latency: It is measure of average time taken by all messages to deliver from source to destination.

IV. RESULT ANALYSIS

For the Scenario-1 the fig.2-a, 2-b, 2-c and for Scenario-2 the fig.3-a, 3-b, 3-c shows the results for the different routing protocol based on three parameters.

Fig.2-a is the comparison of Delivery probability for all the routing protocols.

From the graph we can see that for the 5 nodes the three protocols i.e. Direct Delivery, Epidemic and PRoPHET give almost equal Delivery probability but Spray and Wait protocol gives excellent performance.

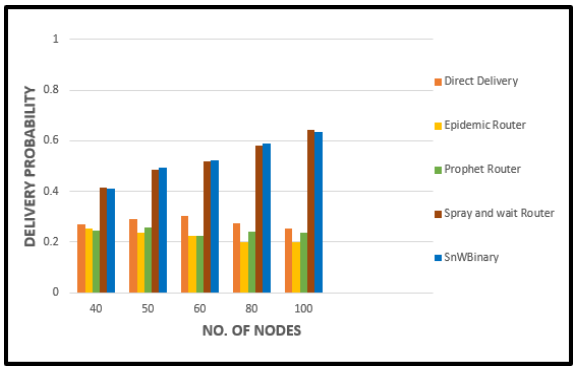

Fig.2-a Delivery prob. vs. No of Nodes

Fig.2-b, is the comparison of Overhead ratio for all the routing protocols. From the chart we can see that the Epidemic is best at the Overhead Ratio contrasting with other protocols.

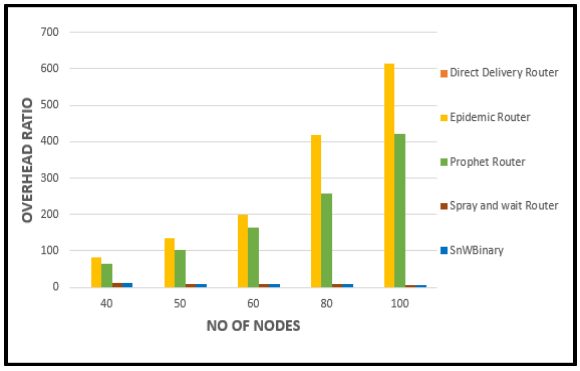

Fig.2-b Overhead Ratio vs. No of Nodes

Fig.2-c, we can see that performance is different for all the protocols. So, we can state that among all protocols

Spray and Wait and Binary Spray and Wait has lowest Latency average overall.

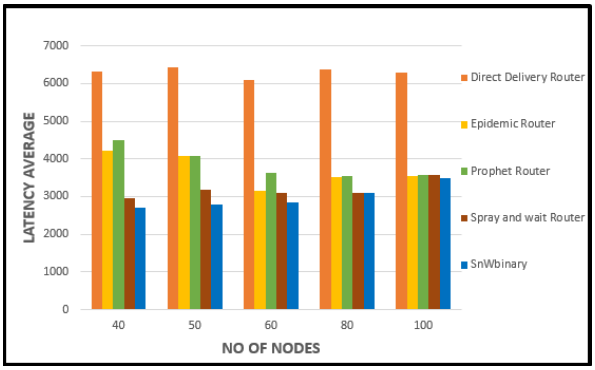

Fig.2-c Latency average vs. No of Nodes

Fig.3-a shows that by varying Message TTL both Spray and Wait and Binary Spray and Wait has the highest Delivery Probability.

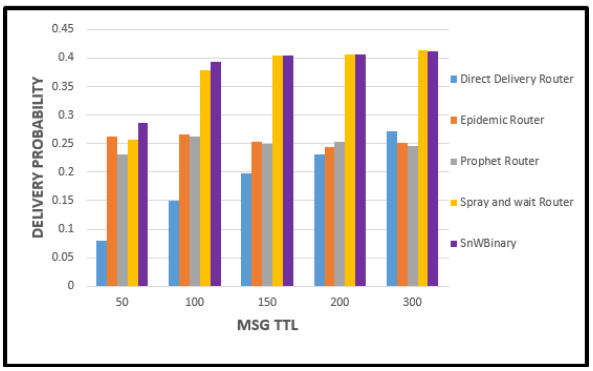

Fig.3-a Delivery prob. vs. MSG TTL

From Fig.3-b we can say that Spray and Wait has the lowest overhead ratio and Epidemic has the highest overhead ratio.

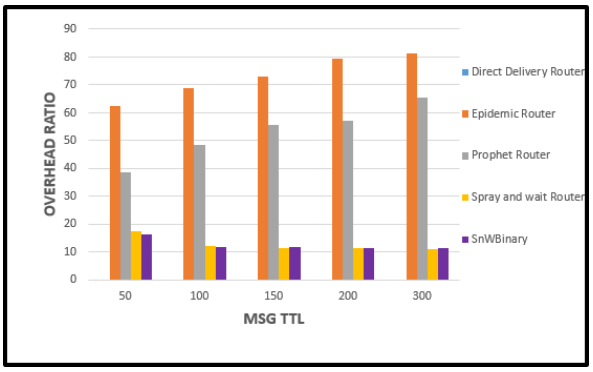

Fig.3-b Overhead Ratio vs. MSG TTL

From Fig.3-c we can say that by increasing the Message TTL time Spray and Wait has lowest Latency average compare to other protocols and Direct delivery has highest than the other protocol. But Binary Spray and Wait is much better at Latency average than normal Spray and wait as it has lowest latency.

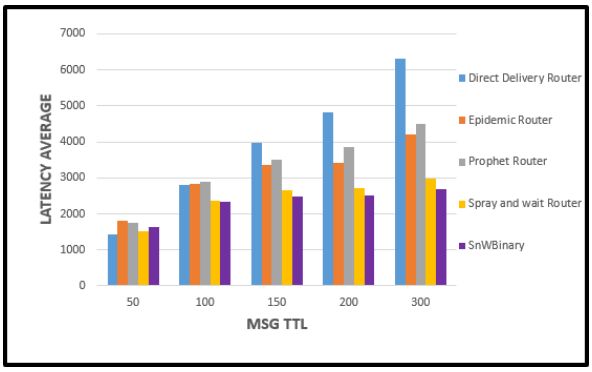

Fig.3-c Latency average vs. MSG TTL

V. CONCLUSION

After analyzing the result of scenarios we conclude that each protocol shows best performance in particular parameters.The Epidemic routing protocol has very poor delivery probability compare to others. By increasing the number of nodes and message TTL time, the Spray and Wait has high delivery probability and less overhead ratio. Direct delivery routing protocol has high latency average.So, among all the protocols Spray and Wait method shows the excellent performance than other routing protocols but Binary Spray and Wait further outperforms standard Spray and Wait protocol.

REFERENCES

[1] Suljiya S A, "Probabilistic Misbehaviour Detection and Optimization in Delay Tolerant Network", IJRET, OCT 2015

[2] Paulo Rog´erio Pereira, Joel J. P. C. Rodrigues, Joan Triay, "From Delay-Tolerant Networks to Vehicular Delay-Tolerant Networks", IEEE COMMUNICATIONS SURVEYS & TUTORIALS

[3] N. Benamar et al., Routing Protocols in Vehicular Delay Tolerant Networks: A Comprehensive survey,Comput.Commun.(2014)http://dx.doi.org/10.1016/j.comcom.2014.03.024

[4] Implementation of a Delay-Tolerant Routing Protocol in the Network Simulator NS-3 by Fredrik Herbertsson LIU-IDA/LITH-EX-A--

10/046--SE 2010-12-22, Linköpings universitet SE-581 83 Linköping, Sweden

[5] Vrunda Gamit, Mr. Hardik Patel, "Evaluation of DTN Routing Protocols", IJESRT, Feb 2014

[6] T Spyropoulos, K. Psounis, and C. S. Raghavendra, "Spray and Wait: An Efficient Routing Scheme for Intermittently Connected Mobile Networks," Proc. ACM SIGCOMM workshop on Delay-Tolerant Networking (WDTN "05) ACM, New York, NY, USA, 2005 pp.252-259.

[7] Eung-Hyup Kim, Jae-Choong Nam, Jae-In Choi, You-Ze Cho "Probability-based Spray and Wait Protocol in Delay Tolerant Networks" IEEE ICOIN, 2014

[8] Hyunwoo Kang, Syed Hassan Ahmed, Dongkyun Kim, and Yun-Su Chung, "Routing Protocols for Vehicular Delay Tolerant Networks: A Survey", IJDSR, 2015